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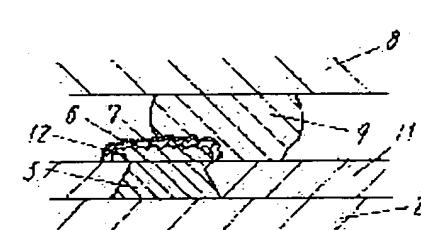
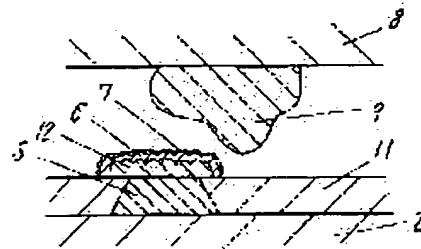
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(54) PRINTED WIRING BOARD, MANUFACTURING METHOD THEREFOR, AND METHOD FOR MOUNTING ELECTRONIC COMPONENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for manufacturing a printed wiring board having component mounting electrodes with a small pitch wherein mounted components are prevented from being moved down from the electrodes on the board.

SOLUTION: A conductive paste layer having an uneven surface is formed on the top of a conductor pattern formed on an insulated substrate and having trapezoidal cross sections. With respect to the printed wiring board, the width of the conductive paste layer is larger than the width of the top of the conductor pattern having trapezoidal cross sections. Thus, the allowance for displacement that may occur during component mounting is increased and the components are prevented from sliding on the electrodes on the substrate. Therefore, the excellent printed wiring board having the effect of preventing contact failure is obtained.



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CLAIMS

[Claim(s)]

[Claim 1] It is the printed wired board which a metal conductive layer is formed in the top chord of the conductor pattern which has the trapezoidal shape cross section formed on the insulating substrate, and said conductor pattern, and is characterized by being size and equipping the front face of said metal conductive layer with much irregularity rather than the width of face of the top chord of the conductor pattern with which the width of face of said metal conductive layer has said trapezoidal shape cross section.

[Claim 2] A metal conductive layer is a printed wired board according to claim 1 characterized by being formed by the conductive paste containing a metal powder and hardenability resin.

[Claim 3] Conductive paste is a printed wired board according to claim 2 characterized by containing the catalyst for promoting a plating deposit.

[Claim 4] A conductor pattern is a printed wired board according to claim 1 characterized by being a connection terminal pattern for planning electrical installation with electronic parts.

[Claim 5] It is the printed wired board which has the insulating resin layer formed on the insulating substrate between the metal conductive layer which is formed on the conductor pattern which has the trapezoidal shape cross section formed on the insulating substrate, and said conductor pattern, and has much irregularity on a front face, and a conductor pattern and a metal conductive layer, and is characterized by forming said insulating resin layer in abbreviation flatness by the thickness of said metal conductive layer and an abbreviation same level.

[Claim 6] The printed wired board according to claim 1 or 5 characterized by forming the layer of non-electrolyzed nickel plating and non-electrolyzed gilding in the front face of a metal conductive layer.

[Claim 7] The manufacture approach of the process which forms the wiring substrate which etches into copper clad laminate the copper foil of a part with which the process which applies and forms a metal conductive layer selectively, and said metal conductive layer are not formed, and has a conductor pattern, and the printed wired board characterized by processing degree process, remained said metal conductive layer on said conductor pattern.

[Claim 8] A metal conductive layer is the manufacture approach of the printed wired board according to claim 7 characterized by forming in conductive paste.

[Claim 9] The processing of degree process performed remained a metal conductive layer on a conductor pattern is the manufacture approach of the printed wired board according to claim 7 characterized by giving non-electrolyzed nickel plating and non-electrolyzed gilding to the front face of said conductor pattern and said metal conductive layer.

[Claim 10] The process which forms the wiring substrate which etches the process which forms etching resist in copper clad laminate selectively, and the copper foil of a part with which said etching resist is not formed, and has a conductor pattern, The manufacture approach of the process which forms an insulating resin layer all over an insulating-substrate top including between conductor patterns, the process ground to smoothness until the front face of a conductor pattern exposes said insulating resin layer, and the printed wired board characterized by carrying out spreading formation of the metal conductive layer in conductive paste on the exposed conductor pattern.

[Claim 11] The manufacture approach of the printed wired board according to claim 10 characterized by performing non-electrolyzed nickel plating and non-electrolyzed gilding on the front face of the metal conductive layer which carried out spreading formation in conductive paste.

[Claim 12] The mounting approach of the electronic parts characterized by joining said connection terminal pattern and connection electrode to the connection terminal pattern of a printed wired board according to claim 4 electrically by contacting said connection electrode of the electronic parts which have a convex connection electrode, and pressurizing said electronic parts.

[Claim 13] The mounting approach of electronic parts of having the process which joins electrically the connection terminal pattern of a printed wired board according to claim 4, and said connection electrode of the electronic parts which have a convex connection electrode, and the process which makes closure resin placed between the clearances between said printed wired boards and said electronic parts.

[Claim 14] The mounting approach of electronic parts of having the process which arranges hardenability resin to said connection terminal pattern top on the printed wired board which has the connection terminal pattern indicated by claim 4, or its near, the process at which said connection electrode of the electronic parts which have a convex connection electrode to said connection terminal pattern is contacted, and the process which hardens said hardenability resin.

[Claim 15] The mounting approach of the electronic parts characterized by fusing solder or a solder ball and joining the connection electrode of electronic parts to the connection terminal pattern of a printed wired board according to claim 4 electrically.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the printed wired board which mounts electronic parts, such as a surface mounted device, especially a bare chip, its manufacture approach, and the mounting approach of electronic parts.

[0002]

[Description of the Prior Art] When the pattern formation approach of the conventional printed wired board is divided roughly, it has two, a subtractive process and an additive process, and mass production nature of a subtractive process is high, and since it can reduce a manufacturing cost, it is used abundantly as the pattern formation approach of a printed wired board.

[0003] Drawing 7 is the production process procedure of the pattern formation by the subtractive process.

[0004] After forming etching resist 4 in the front face of the copper-clad laminate 1 (drawing 7 (A)) which consists of a base material 2 and copper foil 3 according to a photograph process (drawing 7 (B)), after etching reagents, such as a cupric chloride, removed the unnecessary copper foil and forming the predetermined pattern 5, (drawing 7 (C)) and etching resist are exfoliated, and pattern formation is completed (drawing 7 (D)).

[0005] Then, it may leave a component-mounting part to the front face of a wiring substrate if needed, and solder resist may be applied.

[0006] In the case of component mounting, the non-electrolyzed nickel-plating layer 6 is formed on the pattern used as a connection electrode as finishing processing at the last, and the non-electrolyzed gilding layer 7 is formed on it at a pan (drawing 7 (E)).

[0007]

[Problem(s) to be Solved by the Invention] However, by the above-mentioned conventional manufacture approach, in case the copper foil 3 is etched, it is etched not only into the thickness direction but into a longitudinal direction, and the cross-section configuration of a pattern 5 has thin tuck length, and lower width of face becomes thick trapezoidal shape. For this reason, fine patternizing progresses, and tuck length will become thin if it is going to maintain a predetermined gap in the lower width of face between the patterns which adjoin if pattern width of face and a pattern gap become narrow. Moreover, although polish was conventionally put in as pretreatment of each production process, in order to avoid the damage to patterns, such as a chip of the pattern edge section, and a flaw, about a fine pattern, a polish process is skipped as much as possible, or it is in the inclination which loosens the conditions of polish and makes surface irregularity small. Therefore, the front face of the pattern which mounts components is also in the smooth condition.

[0008] When components were mounted on such a pattern, since the tuck length of a pattern was thin, even if it appeared difficultly with a sufficient precision to carry on a pattern the electrode arranged at components with a sufficient precision, since the front face of a pattern was smooth, there was a problem that components slipped down from a pattern and electrical installation could not be taken.

[0009] When this was explained concretely, as shown in drawing 8, the bump 9 who is a

connection electrode with the substrate arranged at the bare chip 8 slipped down from the pattern 5 with the pressure at the time of mounting, and nonconformity, like a bare chip starts an inclination and a poor contact had occurred.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned object, this invention has the following configurations.

[0011] The metal conductive layer which has a rectangle-like cross section is formed in the top chord of the conductor pattern with which especially invention of this invention according to claim 1 was formed on the insulating substrate. The width of face of said metal conductive layer Rather than the width of face of the top chord of a conductor pattern, are size and the front face of said metal conductive layer has the configuration of a printed wired board equipped with much irregularity. In case the electrode arranged by this at components is carried on a metal conductive layer, while the tolerance about a location gap becomes large Since components do not slide on a metal conductive layer top according to the anchor effect by the irregularity of a large number in the front face of a metal conductive layer, components slip down from the pattern of a substrate and can prevent nonconformity, such as starting a poor contact.

[0012] The components mounted since invention of this invention according to claim 2 has the configuration of the printed wired board according to claim 1 currently formed by the conductive paste in which especially the metal conductive layer contained a metal powder and hardenability resin and the irregularity of a large number according to the configuration of the metal powder used for conductive paste and particle size is shown in the front face of the mounting electrode of a substrate by this slide on the electrode top of a substrate, and do not slip down.

[0013] Especially the electric conduction pattern has the configuration of the printed wired board containing the catalyst for promoting a plating deposit according to claim 2, and since invention of this invention according to claim 3 can promote that copper plating, nickel plating, and gilding deposit on conductive paste by this, it can obtain the mounting electrode which has the stable bonding nature.

[0014] Invention of this invention according to claim 4 has the configuration of the printed wired board according to claim 1 which is a connection terminal pattern for planning electrical installation with electronic parts, and also with the high density substrate of the ** pitch which was a difficult field in the conventional subtractive process by this, especially a conductor pattern becomes possible [forming a metal conductive layer only with the width of face which can carry a surface mounted device], and it can apply it also to BGA which mounts a bare chip, and the substrate for CSP.

[0015] The conductor pattern which has the trapezoidal shape cross section where invention of this invention according to claim 5 was formed on the insulating substrate. It has the insulating resin layer formed on the insulating substrate between the metal conductive layer which is formed on it and has much irregularity on a front face, and a conductor pattern and a metal conductive layer. In case this insulating resin layer has a configuration called the printed wired board currently formed in abbreviation flatness by the thickness of a metal conductive layer and an abbreviation same level and forms solder resist by this, in a pattern gap, the unarrival or void of solder resist do not occur like before, but it can be thinly applied to homogeneity. Moreover, in the clearance between components and a substrate, for the improvement in connection dependability, also in case closure resin is poured in, the contamination of a void can be prevented.

[0016] Invention of this invention according to claim 6 has a configuration called the printed wired board according to claim 1 or 5 which forms the layer of non-electrolyzed nickel plating and non-electrolyzed gilding in the front face of the exposed metal conductive layer, and since the leading-about line for the energization which is needed by this in electrolysis nickel plating and electrolysis gilding becomes unnecessary, it can raise a wiring consistency and a component-mounting consistency. Moreover, the mounting electrode which prevents the oxide film generation to a metal conductive layer front face, and has the stable bonding nature can be obtained by forming a nickel-plating layer in the front face of the exposed metal conductive layer, and forming a gilding layer on it.

[0017] It says that especially invention of this invention according to claim 7 processes degree process, etched the copper foil of a part with which a metal conductive layer is selectively applied and formed, and the metal conductive layer is not formed, formed a conductor pattern, and remained said metal conductive layer on a conductor pattern, and a metal conductive layer with the fixed width of face which is not influenced by the etching condition at the time of this forming a conductor pattern is obtained.

[0018] Especially a metal conductive layer calls invention of this invention according to claim 8 the manufacture approach of the printed wired board according to claim 7 formed in conductive paste, and it has the irregularity of a large number according to the configuration of the metal powder used for conductive paste, and particle size in the front face of a metal conductive layer which serves as a mounting electrode of a substrate by this. From the electrode of a substrate, the components mounted according to the anchor effect by this irregularity slip down, and do not incline.

[0019] The processing of degree process performed while especially invention of this invention according to claim 9 had remained the metal conductive layer on the conductor pattern It is a thing called the manufacture approach of the printed wired board according to claim 7 to which it is supposed that non-electrolyzed nickel plating and non-electrolyzed gilding are given to the front face of a conductor pattern and a metal conductive layer. While being able to obtain the mounting electrode which prevents the oxide film generation to a metal conductive layer front face by this, and has the stable bonding nature, the side face of the conductor pattern exposed by etching can be rustproofed.

[0020] Especially invention of this invention according to claim 10 etches the copper foil of a part with which etching resist is not formed, and forms a conductor pattern. After grinding to smoothness until it forms an insulating resin layer the whole surface on a wiring substrate including between conductor patterns and the front face of a conductor pattern exposes an insulating resin layer. It is a thing called the manufacture approach of the printed wired board which carries out spreading formation of the metal conductive layer with a paste on the exposed conductor pattern. Since the mounting electrode which has the fixed width of face which is not influenced by the etching condition by this, and has much irregularity in a front face is obtained, components slip down from a mounting electrode and can prevent nonconformity, such as starting an inclination and a poor contact.

[0021] Especially invention of this invention according to claim 11 can be called manufacture approach of the printed wired board according to claim 10 to which it is supposed that non-electrolyzed nickel plating and non-electrolyzed gilding are performed on the front face of the metal conductive layer which carried out spreading formation in conductive paste, and can obtain the mounting electrode which prevents the oxide film generation to a metal conductive layer front face by this, and has the stable bonding nature.

[0022] Especially invention of this invention according to claim 12 to the connection terminal pattern of a printed wired board according to claim 4 It is a thing called the mounting approach of the electronic parts which join a connection electrode to a connection terminal pattern electrically by contacting said connection electrode and pressurizing the convex connection electrode of electronic parts. The anchor effect by the irregularity of a large number which the width of face of a connection terminal pattern is secured enough by this, and exist in a front face sake, At the time of mounting, even if a pressure is applied to electronic parts, the connection electrode of electronic parts slips down from a connection terminal pattern, and can prevent nonconformity, such as starting an inclination and a poor contact.

[0023] Especially invention of this invention according to claim 13 The connection terminal pattern of a printed wired board according to claim 4, It is a thing called the mounting approach of electronic parts of joining the convex connection electrode of electronic parts electrically, and making closure resin placed between the clearances between a printed wired board and electronic parts. As opposed to the technical problem that water goes into the clearance between the closure resin which had become a problem in the reliability trial under high-humidity/temperature especially with the conventional substrate by this, and a substrate electrode, corrode the electrode of a substrate, and it results in an open circuit In the substrate

of this invention, since much irregularity is in the electrode of a substrate, the adhesion force with closure resin is improved, encroachment of water is prevented, and dependability improves.

[0024] Invention of this invention according to claim 14 arranges hardenability resin to the connection terminal pattern top on the printed wired board of claim 4, or its near. Contact the convex connection electrode of electronic parts to a connection terminal pattern, and it considers as the mounting approach of the electronic parts which harden said hardenability resin. Thereby, like claim 13, since much irregularity is in the electrode of a substrate, the adhesion force of a substrate electrode and hardenability resin is improved, encroachment of water is prevented, and dependability improves.

[0025] Especially invention of this invention according to claim 15 The connection terminal pattern of a printed wired board according to claim 4, It is a thing called the mounting approach of the electronic parts which fuse solder or a solder ball and join the connection electrode of electronic parts electrically. Since the connection terminal pattern equips the front face with much irregularity by this, in case the connection electrode, solder, or solder ball of electronic parts is fused and it joins electrically according to the anchor effect by this irregularity, high soldered joint reinforcement can be maintained.

[0026]

[Embodiment of the Invention] (Gestalt 1 of operation) Drawing 1 and drawing 2 are production process drawings of the printed wired board in the gestalt 1 of operation of this invention.

[0027] In drawing 1 and drawing 2 , with this operation gestalt, the copper-clad laminate which comes to stick the copper foil 3 as a conductive layer on both sides of for example, a glass epoxy group plate is used for a base material 2 as a wiring substrate 10, and – (D) completes pattern formation with a subtractive process similarly even with drawing 1 (A) drawing 7 [which shows a Prior art] (A) – (D).

[0028] Next, the insulating resin layer 11 is formed in the front face of the wiring substrate 10. After using the epoxy system resin of a heat-curing mold, applying by the screen printer, curtain coater, slot coater, etc. as this insulating resin ingredient and changing into the condition of the set to touch at a heat-curing furnace, an insulating resin ingredient is applied also like the rear-face side of the wiring substrate 10, and double-sided coincidence is stiffened at a heat-curing furnace (drawing 2 (E)).

[0029] Next, the hardened insulating resin layer 11 is ground. A belt sander, a buffering machine, etc. are used as polish equipment, and it grinds to smoothness until a pattern 5 is exposed to a front face (drawing 2 (F)).

[0030] Next, the conductive paste 12 used as a mounting electrode is formed on the pattern which mounts components. It is what mixed a solvent and additives, such as metal powders, such as copper, silver, and gold, resin, such as epoxy, a phenol, methacrylic one, and ethyl cellulose, ethyl carbitol, and butyl acetate, as this conductive paste ingredient, and catalysts, such as palladium, are added in order to promote that copper plating, nickel plating, and gilding deposit on conductive paste.

[0031] 5x10 to 5 or less ohm-cm of volume resistivities is obtained by the conductive paste which used 55 – 65% of silver dust with a mean particle diameter of 3-7 micrometers, 8 – 10% of epoxy resins, and the remainder as the solvent for the metal powder with a particle size of 0.1-15 micrometers desirably with 7 – 25% of resin 25 to 80% by the weight ratio as a presentation ratio, and used ethyl carbitol. Moreover, as the method of application, there are a dispenser method, an imprint method, a screen method, etc. In addition, spreading area is set up in consideration of the location gap at the time of mounting (drawing 2 (G)).

[0032] Then, it may leave a component-mounting part to the front face of a wiring substrate if needed, and solder resist may be applied.

[0033] Finally, nickel plating and gilding processing are performed to the part which conductive paste layers, such as a component-mounting part, exposed as finishing processing. This nickel-plating layer 6 and the gilding layer 7 are carried out with nonelectrolytic plating (drawing 2 (H)).

[0034] Moreover, since adhesion with the stable electrolyte thickness and conductive paste, and a nickel-plating layer is raised, a non-electrolytic copper plating layer may be carried out on a conductive paste layer just before nickel plating.

[0035] According to the configuration and the manufacture approach of a printed wired board in <the advantage of this operation gestalt>, thus the gestalt of this operation, the following effectiveness is acquired.

[0036] (1) Pattern tuck length required for component mounting can be secured, and tolerance becomes large about the location gap at the time of mounting. The tuck length of a pattern which mounts components is decided by width of face of the conductive paste layer 12, and since this width of face is not controlled with the width of face of the mask to be used in the case of a screen method and influenced by the etching condition of a pattern 5, the stable fixed component-mounting electrode width of face is obtained.

[0037] (2) From the electrode of a substrate, the components mounted since much irregularity is shown in the front face of the mounting electrode of a substrate as shown in drawing 3 slip down, and do not incline. With this operation gestalt, since the mounting electrode consists of conductive paste, much irregularity is shown in an electrode surface by the metal powder. For example, the electrode surface formed by the conductive paste which comes to mix piece of phosphorus-like silver dust with a particle size of 0.1-2 micrometers to spherical silver dust with a mean particle diameter of 3 micrometers is 2.0-3.0 micrometers in the average of roughness height, and even if a pressure is applied at the time of component mounting, in order that components may not slide on the electrode top of a substrate or may not slip down and incline according to the anchor effect by this irregularity, its mounting yield improves.

[0038] (3) The connection dependability of the components mounted since much irregularity is shown in the front face of the mounting electrode of a substrate as shown in drawing 3 , and the electrode of a substrate improves. If moderate irregularity is in a mounting electrode also in a wirebonding method or a flip chip method, in order that adhesion may go up by the anchor effect, connection dependability improves. For example, it turned out as an index showing bond strength that the ball shear strength is improved 1.4 times as compared with the conventional substrate.

[0039] Moreover, the adhesion of the undershirt philharmonic material poured in in case flip chip mounting of the bare chip is carried out also improves.

[0040] (4) Since the substrate is flat, when forming solder resist, if it is the conventional substrate as shown in drawing 4 , the unarrival 14 and void 15 of solder resist 13 by printing blur will occur in a pattern gap. Especially future and fine patterning progresses, and it will become remarkable if the gap of a pattern becomes narrow. With this operation gestalt, since flattening of the substrate is carried out in the insulating resin layer 11, it is thin and can apply [that there is also no generating of unarrival 14 or a void 15, or] to homogeneity.

[0041] (5) Impregnation of the undershirt philharmonic material at the time of carrying out flip chip mounting of the bare chip at a substrate is easy, and there is no generating of a void. As shown in drawing 5 , in flip chip mounting, closure resin 16 is poured into the clearance between a bare chip 8 and a substrate 10 in many cases for the improvement in connection dependability. At this impregnation process, it has been a big technical problem how you lose involvement of a void and are made to pour in early, while ** pitch-ization of a pattern progresses.

[0042] with this operation gestalt, although it was difficult to suppress generating of a void 17 in the conventional substrate, since flattening of the substrate front face is carried out by the insulating resin layer 11, generating of a void is markedly alike, and decreases and the time amount of impregnation is shortened substantially. In addition, also when using that to which resin contains a film-like thing in addition to the shape of a paste, and contains an electric conduction particle in resin, and the thing which is not included in the case of the pressure-welding method of construction which maintains the electrical connection of a bare chip and a substrate instead of this closure resin using hardening contraction of resin, there is same effectiveness.

[0043] (6) Since the build up wiring substrate currently used widely as a high density substrate or a bare chip substrate forms the circuit pattern and the component-mounting pattern by the copper-plating layer deposited on insulating resin and its Peel reinforcement and pull reinforcement of the copper foil are low, the components omission from a substrate pose a problem. Since the side face of the copper foil is covered with the insulating resin layer, the Peel reinforcement and pull reinforcement of the substrate by this operation gestalt improve

substantially.

[0044] (Gestalt 2 of operation) Drawing 6 is production process drawing of the printed wired board in the gestalt 2 of operation of this invention.

[0045] The same conductive paste 12 as the gestalt 1 of the operation to the wiring substrate 10 (drawing 6 (A)) which consists of a base material 2 and copper foil 3 is applied on the copper foil used as a predetermined pattern (drawing 6 (B)).

[0046] Etching reagents, such as cupric chloride, remove the unnecessary copper foil by making this conductive paste 12 into etching resist, and the predetermined pattern 5 is formed (drawing 6 (C)).

[0047] Then, after leaving the component-mounting part to the front face of a wiring substrate if needed and applying solder resist, the non-electrolyzed nickel plating 6 and non-electrolyzed gilding 7 are given to the part which conductive paste layers, such as a component-mounting part, exposed as finishing processing like the gestalt 1 of operation.

[0048] While pattern tuck length required for component mounting is securable also in this operation gestalt, components do not slip down from the electrode of a substrate according to the anchor effect by the irregularity of the mounting electrode of a substrate. Moreover, since the adhesion force becomes firm, connection dependability also improves.

[0049]

[Effect of the Invention] As mentioned above, according to this invention, the conductive paste layer which has surface irregularity is formed in the top chord of a conductor pattern which has the trapezoidal shape cross section formed on the insulating substrate. By the printed wired board which is size, the width of face of this conductive paste layer rather than the width of face of the top chord of a conductor pattern which has said trapezoidal shape cross section Since components do not slide on the electrode top of a substrate while the tolerance about the location gap at the time of mounting components becomes large, the outstanding printed wired board effective in control of a poor contact is realizable.

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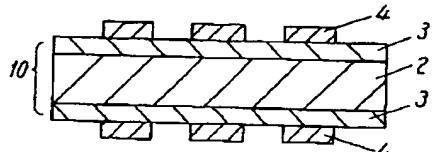
DRAWINGS

[Drawing 1]

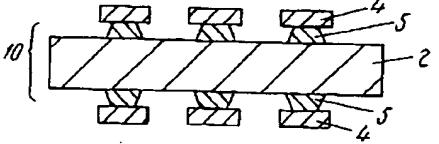
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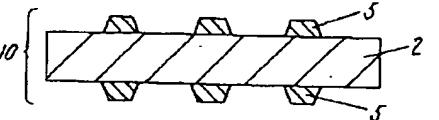
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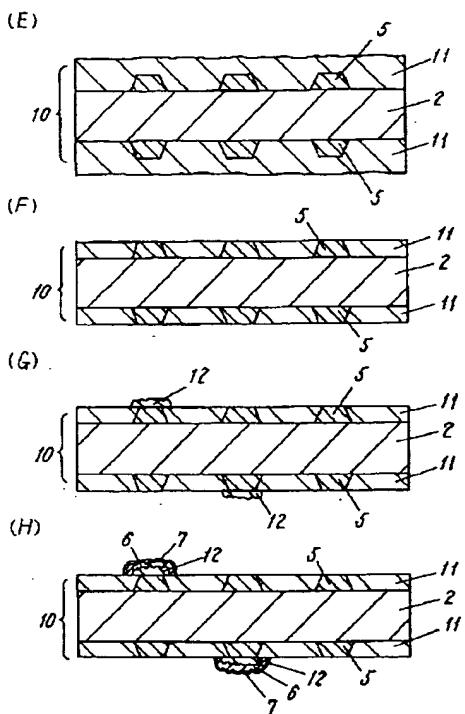
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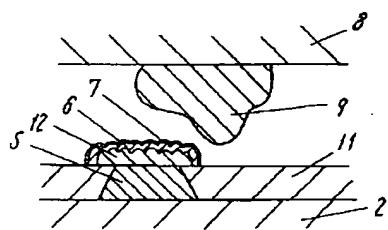


[Drawing 2]

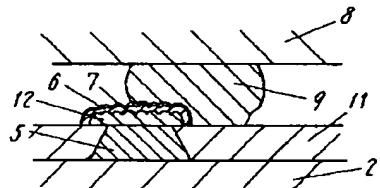


[Drawing 3]

(a)

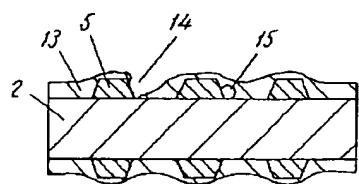


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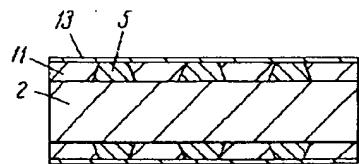


[Drawing 4]

(a)

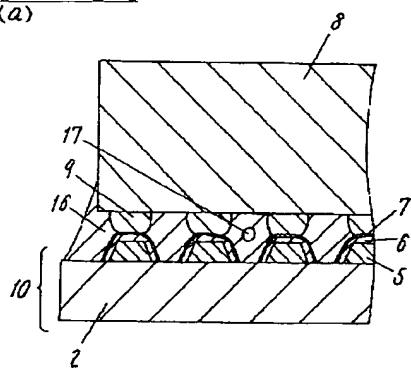


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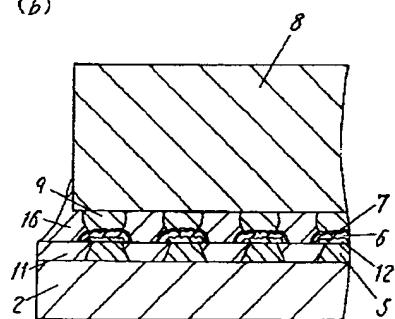


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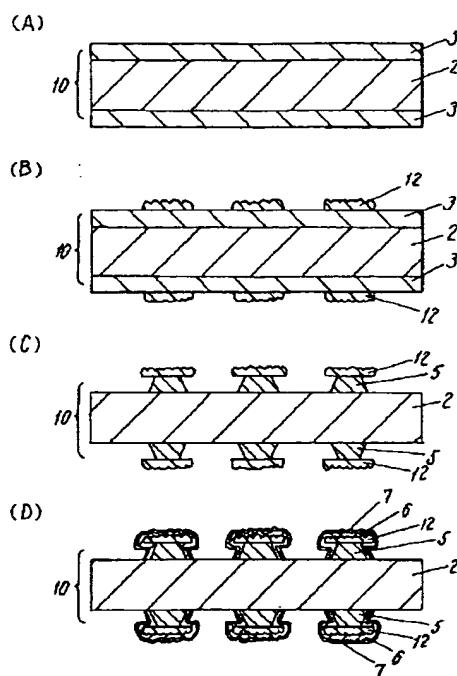
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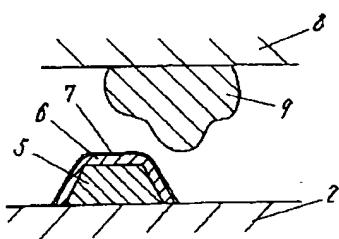


[Drawing 6]

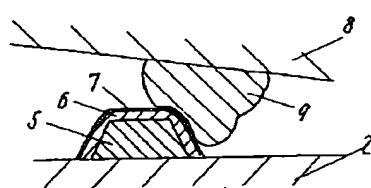


[Drawing 8]

(a)

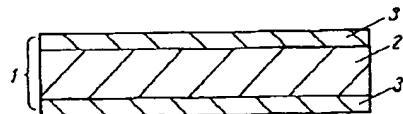


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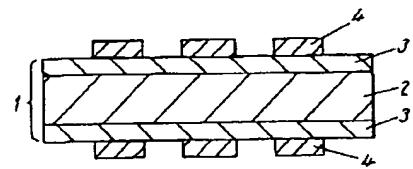


[Drawing 7]

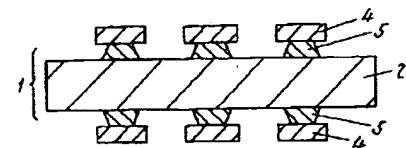
(A)



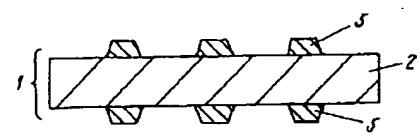
(B)



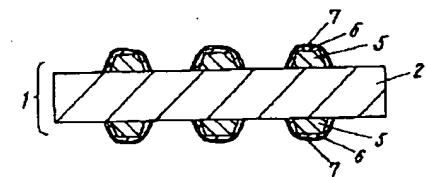
(C)



(D)



(E)



[Translation done.]

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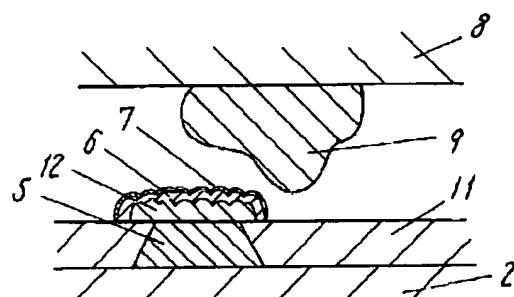
(54)【発明の名称】 プリント配線板とその製造方法および電子部品の実装方法

(57)【要約】

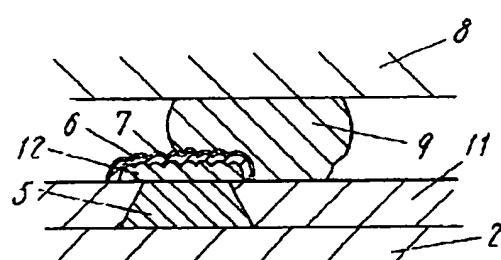
【課題】 狹ピッチの部品実装電極を有するプリント配線板の製造方法において、実装する部品が基板の電極からずれ落ちるのを阻止したプリント配線板の製造方法を提供することを目的とする。

【解決手段】 絶縁基板上に形成された台形状断面を有する導体パターンの上辺に表面凹凸を有する導電ペースト層を形成し、この導電ペースト層の幅が前記台形状断面を有する導体パターンの上辺の幅よりも大であるプリント配線板により、部品を実装する際の位置ずれに関する許容度が大きくなるとともに部品が基板の電極上を滑ることがないため、接触不良の抑制に有効な優れたプリント配線板を実現できるものである。

(a)



(b)



【特許請求の範囲】

【請求項1】 絶縁基板上に形成された台形状断面を有する導体パターンと、前記導体パターンの上辺に金属導電層が形成され、前記金属導電層の幅は、前記台形状断面を有する導体パターンの上辺の幅よりも大であり、かつ前記金属導電層の表面は多数の凹凸を備えたことを特徴とするプリント配線板。

【請求項2】 金属導電層は、金属粉と硬化性樹脂を含有した導電ペーストで形成されていることを特徴とする請求項1に記載のプリント配線板。

【請求項3】 導電ペーストは、めっき析出を促進させるための触媒を含有していることを特徴とする請求項2に記載のプリント配線板。

【請求項4】 導体パターンは、電子部品との電気的接続を図るための接続端子パターンであることを特徴とする請求項1に記載のプリント配線板。

【請求項5】 絶縁基板上に形成された台形状断面を有する導体パターンと、前記導体パターン上に形成されかつ表面に多数の凹凸を有する金属導電層と、導体パターン及び金属導電層の間の絶縁基板上に形成された絶縁樹脂層を有し、前記絶縁樹脂層は前記金属導電層と略同一水準の厚さで略平坦に形成されていることを特徴とするプリント配線板。

【請求項6】 金属導電層の表面に無電解ニッケルめっきと無電解金めっきの層を形成したことを特徴とする請求項1または請求項5に記載のプリント配線板。

【請求項7】 銅張積層板に金属導電層を選択的に塗布・形成する工程と、前記金属導電層が形成されていない部分の銅はくをエッチングし導体パターンを有する配線基板を形成する工程と、前記導体パターン上に前記金属導電層を残存したまま次工程の処理を行うことを特徴とするプリント配線板の製造方法。

【請求項8】 金属導電層は、導電ペーストにて形成することを特徴とする請求項7に記載のプリント配線板の製造方法。

【請求項9】 導体パターン上に金属導電層を残存したまま行う次工程の処理は、前記導体パターンと前記金属導電層の表面に無電解ニッケルめっきと無電解金めっきを施すことを特徴とする請求項7に記載のプリント配線板の製造方法。

【請求項10】 銅張積層板にエッチングレジストを選択的に形成する工程と、前記エッチングレジストが形成されていない部分の銅はくをエッチングし導体パターンを有する配線基板を形成する工程と、導体パターン間を含む絶縁基板上全面に絶縁樹脂層を形成する工程と、前記絶縁樹脂層を導体パターンの表面が露出するまで平滑に研磨する工程と、露出した導体パターン上に金属導電層を導電ペーストにて塗布形成することを特徴とするプリント配線板の製造方法。

【請求項11】 導電ペーストにて塗布形成した金属導

電層の表面に無電解ニッケルめっきと無電解金めっきを行うことを特徴とする請求項10に記載のプリント配線板の製造方法。

【請求項12】 請求項4記載のプリント配線板の接続端子パターンに、凸状の接続電極を有する電子部品の前記接続電極を接触させ、前記電子部品を加圧することによって前記接続端子パターンと接続電極を電気的に接合することを特徴とする電子部品の実装方法。

【請求項13】 請求項4記載のプリント配線板の接続端子パターンと、凸状の接続電極を有する電子部品の前記接続電極を電気的に接合する工程と、前記プリント配線板と前記電子部品との隙間に封止樹脂を介在させる工程を有する電子部品の実装方法。

【請求項14】 請求項4に記載された接続端子パターンを有するプリント配線板上の前記接続端子パターン上またはその近傍に硬化性樹脂を配置する工程と、前記接続端子パターンに、凸状の接続電極を有する電子部品の前記接続電極を接触させる工程と、前記硬化性樹脂を硬化する工程を有する電子部品の実装方法。

【請求項15】 請求項4記載のプリント配線板の接続端子パターンと、電子部品の接続電極をはんだ、またははんだボールを溶融して電気的に接合することを特徴とする電子部品の実装方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、表面実装部品、特にベアチップ等の電子部品を実装するプリント配線板とその製造方法および電子部品の実装方法に関するものである。

【0002】

【従来の技術】 従来のプリント配線板のパターン形成方法は、大別するとサブトラクティブ法とアディティブ法の二つがあり、サブトラクティブ法は量産性が高く、製造コストを低減できることからプリント配線板のパターン形成方法として多用されている。

【0003】 図7はサブトラクティブ法によるパターン形成の製造工程手順である。

【0004】 基材2と銅はく3からなる銅張り積層板1(図7(A))の表面にフォトプロセスによりエッチングレジスト4を形成した後(図7(B))、塩化第二銅などのエッチング液により不要な銅はくを除去して所定のパターン5を形成したうえで(図7(C))、エッチングレジストを剥離してパターン形成が完了する(図7(D))。

【0005】 その後、必要に応じて配線基板の表面に部品実装部分を残してソルダレジストを塗布することもある。

【0006】 最後に、仕上げ処理として、部品実装の際、接続電極となるパターンの上に無電解ニッケルめっき層6、さらにその上に無電解金めっき層7を形成する

(図7 (E))。

【0007】

【発明が解決しようとする課題】ところが、上記従来の製造方法では、銅はく3をエッチングする際、厚み方向だけではなく横方向にもエッチングされパターン5の断面形状は上幅が細く、下幅が太い台形状になる。このためファインパターン化が進み、パターン幅とパターン間隙が狭くなってくると隣接するパターン間の下幅において所定の間隙を保とうとすると上幅が細くなってしまう。また従来各製造工程の前処理として研磨を入れていたが、パターンエッジ部の欠け、きずなどパターンへのダメージを避けるため、ファインパターンについては可能な限り研磨工程を省いたり、研磨の条件を緩めて表面凹凸を小さくする傾向にある。そのため部品を実装するパターンの表面も滑らかな状態となっている。

【0008】このようなパターンの上に部品を実装する場合、パターンの上幅が細いため、部品に配置された電極をパターン上に精度よく載せるのが難しく、また精度よく載ったとしてもパターンの表面が滑らかなため、部品がパターンからずれ落ちたりして電気的接続がとれないという問題があった。

【0009】これを具体的に説明すると図8に示すように、ペアチップ8に配置された基板との接続電極であるバンプ9が実装時の圧力によりパターン5からずれ落ちてペアチップが傾き、接触不良を起こすなどの不具合が発生していた。

【0010】

【課題を解決するための手段】上記目的を達成するために、本発明は以下の構成を有する。

【0011】本発明の請求項1に記載の発明は、特に、絶縁基板上に形成された導体パターンの上辺に矩形状断面を有する金属導電層が形成され、前記金属導電層の幅は、導体パターンの上辺の幅よりも大であり、かつ前記金属導電層の表面は多数の凹凸を備えているプリント配線板の構成を有しており、これにより部品に配置された電極を金属導電層上に載せる際、位置ずれに関する許容度が大きくなるとともに、金属導電層の表面にある多数の凹凸によるアンカー効果によって部品が金属導電層上を滑ることがないため、部品が基板のパターンからずれ落ちたりして接触不良を起こすなどの不具合を防止することができる。

【0012】本発明の請求項2に記載の発明は、特に、金属導電層は、金属粉と硬化性樹脂を含有した導電ペーストで形成されている請求項1に記載のプリント配線板の構成を有しており、これにより基板の実装電極の表面には導電ペーストに使用する金属粉の形状、粒径に応じた多数の凹凸があるため実装する部品が基板の電極上を滑ってずれ落ちることがない。

【0013】本発明の請求項3に記載の発明は、特に、導電パターンは、めっき析出を促進させるための触媒を

含有している請求項2に記載のプリント配線板の構成を有しており、これにより導電ペーストの上に銅めっきやニッケルめっき、金めっきが析出するのを促進させることができるために、安定したボンディング性を有する実装電極を得ることができる。

【0014】本発明の請求項4に記載の発明は、特に、導体パターンは、電子部品との電気的接続を図るための接続端子パターンである請求項1に記載のプリント配線板の構成を有しており、これにより従来サブトラクティブ法では困難な領域であった狭ピッチの高密度基板でも表面実装部品を載せることができるだけの幅をもった金属導電層を形成することが可能となり、ペアチップを実装するBGA、CSP用の基板にも適用できる。

【0015】本発明の請求項5に記載の発明は、絶縁基板上に形成された台形状断面を有する導体パターンと、その上に形成されかつ表面に多数の凹凸を有する金属導電層と、導体パターン及び金属導電層の間の絶縁基板上に形成された絶縁樹脂層を有し、この絶縁樹脂層は金属導電層と略同一水準の厚さで略平坦に形成されているプリント配線板という構成を有しており、これによりソルダレジストを形成する際、従来のようにパターン間隙においてソルダレジストの未着やボイドが発生せず、薄く均一に塗布できる。また部品と基板の隙間に接続信頼性向上のため、封止樹脂を注入する際もボイドの巻き込みを防止できる。

【0016】本発明の請求項6に記載の発明は、露出した金属導電層の表面に無電解ニッケルめっきと無電解金めっきの層を形成する請求項1または請求項5に記載のプリント配線板という構成を有しており、これにより電解ニッケルめっきと電解金めっきの場合に必要となる通電のための引き回し線が不要となるため、配線密度と部品実装密度を上げることができる。また露出した金属導電層の表面にニッケルめっき層、その上に金めっき層を形成することにより、金属導電層表面への酸化膜生成を防止し、安定したボンディング性を有する実装電極を得ることができる。

【0017】本発明の請求項7に記載の発明は、特に、金属導電層を選択的に塗布・形成し、金属導電層が形成されていない部分の銅はくをエッチングし導体パターンを形成し、導体パターン上に前記金属導電層を残存したまま次工程の処理を行うというものであり、これにより導体パターンを形成する際のエッチング状態に左右されない一定の幅をもった金属導電層が得られる。

【0018】本発明の請求項8に記載の発明は、特に、金属導電層は導電ペーストにて形成する請求項7に記載のプリント配線板の製造方法というものであり、これにより基板の実装電極となる金属導電層の表面には導電ペーストに使用する金属粉の形状、粒径に応じた多数の凹凸がある。この凹凸によるアンカー効果により実装する部品が基板の電極からずれ落ちて傾いたりしない。

【0019】本発明の請求項9に記載の発明は、特に、導体パターン上に金属導電層を残存したまま行う次工程の処理は、導体パターンと金属導電層の表面に無電解ニッケルめっきと無電解金めっきを施すこととする請求項7に記載のプリント配線板の製造方法というものであり、これにより金属導電層表面への酸化膜生成を防止し、安定したボンディング性を有する実装電極を得ることができるとともにエッチングによって露出した導体パターンの側面を防錆することができる。

【0020】本発明の請求項10に記載の発明は、特に、エッチングレジストが形成されていない部分の銅はくをエッチングして導体パターンを形成し、導体パターン間を含む配線基板上の全面に絶縁樹脂層を形成し、絶縁樹脂層を導体パターンの表面が露出するまで平滑に研磨した後、露出した導体パターン上に金属導電層をペーストにて塗布形成するプリント配線板の製造方法というものであり、これによりエッチング状態に左右されない一定の幅を持ち、かつ表面に多数の凹凸のある実装電極が得られるため、部品が実装電極からずれ落ちて傾き、接触不良を起こすなどの不具合を防止することができる。

【0021】本発明の請求項11に記載の発明は、特に、導電ペーストにて塗布形成した金属導電層の表面に無電解ニッケルめっきと無電解金めっきを行うこととする請求項10に記載のプリント配線板の製造方法というものであり、これにより金属導電層表面への酸化膜生成を防止し、安定したボンディング性を有する実装電極を得ることができる。

【0022】本発明の請求項12に記載の発明は、特に、請求項4記載のプリント配線板の接続端子パターンに、電子部品の凸状の接続電極を前記接続電極を接触、加圧することで接続端子パターンと接続電極を電気的に接合する電子部品の実装方法というものであり、これにより接続端子パターンの幅は十分確保されており、かつ表面に存在する多数の凹凸によるアンカー効果のため、実装時、電子部品に圧力がかかっても電子部品の接続電極が接続端子パターンからずれ落ちて傾き、接触不良を起こすなどの不具合を防止することができる。

【0023】本発明の請求項13に記載の発明は、特に、請求項4記載のプリント配線板の接続端子パターンと、電子部品の凸状の接続電極を電気的に接合し、プリント配線板と電子部品との隙間に封止樹脂を介在させる電子部品の実装方法というものであり、これにより従来の基板では特に、高温高湿下における信頼性試験において問題となっていた封止樹脂と基板電極の隙間に水が入り基板の電極を腐食し断線に至るという課題に対して、本発明の基板では基板の電極に多数の凹凸があるため封止樹脂との密着力が上がり、水の浸入が防止され信頼性が向上する。

【0024】本発明の請求項14に記載の発明は、請求

項4のプリント配線板上の接続端子パターン上またはその近傍に硬化性樹脂を配置し、接続端子パターンに、電子部品の凸状の接続電極を接触させ、前記硬化性樹脂を硬化する電子部品の実装方法としたものであり、これにより請求項13と同様、基板の電極に多数の凹凸があるため基板電極と硬化性樹脂との密着力が上がり、水の浸入が防止され信頼性が向上する。

【0025】本発明の請求項15に記載の発明は、特に、請求項4記載のプリント配線板の接続端子パターンと、電子部品の接続電極をはんだ、またははんだボールを溶融して電気的に接合する電子部品の実装方法というものであり、これにより接続端子パターンが表面に多数の凹凸を備えていることから、この凹凸によるアンカー効果により、電子部品の接続電極とはんだ、またははんだボールを溶融して電気的に接合する際に高いはんだ接合強度を維持することができる。

【0026】

【発明の実施の形態】(実施の形態1) 図1および図2は本発明の実施の形態1におけるプリント配線板の製造工程図である。

【0027】図1および図2において、本実施形態では配線基板10として、基材2には例えばガラスエポキシ基板の両面に導電層としての銅はく3を貼り付けてなる銅張り積層板を使用しており、図1(A)～(D)までは従来の技術を示す図7(A)～(D)までと同様、サブトラクティブ法によりパターン形成を完了する。

【0028】次に、配線基板10の表面に絶縁樹脂層11を形成する。この絶縁樹脂材料としては、熱硬化型のエポキシ系樹脂を使用し、スクリーン印刷機、カーテンコーダ、スロットコーダなどで塗布した後、熱硬化炉で指触乾燥の状態にしたうえで、配線基板10の裏面側にも同様に絶縁樹脂材料を塗布して、熱硬化炉で両面同時に硬化させる(図2(E))。

【0029】次に、硬化した絶縁樹脂層11を研磨する。研磨装置としては例えばベルトサンダーやバフ研磨機などを使用し、パターンが表面に露出されるまで平滑に研磨する(図2(F))。

【0030】次に、部品を実装するパターンの上に実装電極となる導電ペースト12を形成する。この導電ペースト材料としては銅、銀、金などの金属粉とエポキシ、フェノール、メタクリル、エチルセルロースなどの樹脂とエチルカルビトール、酢酸ブチルなどの溶剤および添加剤を混合したもので、導電ペーストの上に銅めっきやニッケルめっき、金めっきが析出するのを促進させるためパラジウムなどの触媒を添加したものである。

【0031】組成比としては粒径0.1～15μmの金属粉を重量比で25～80%、樹脂7～25%で望ましくは平均粒径3～7μmの銀粉55～65%、エポキシ樹脂8～10%、残りを溶剤としてエチルカルビトールを使用した導電ペーストにより体積抵抗率5×10⁻⁵Ω

· cm以下が得られる。また塗布方法としてはディスパンサ方式、転写方式、スクリーン方式等がある。なお塗布面積は実装時の位置ずれを考慮して設定する(図2 (G))。

【0032】その後、必要に応じて配線基板の表面に部品実装部分を残してソルダレジストを塗布することもある。

【0033】最後に、仕上げ処理として、部品実装部分などの導電ペースト層が露出した部分にニッケルめっきおよび金めっき処理を施す。このニッケルめっき層6、金めっき層7は無電解めっきにより実施する(図2 (H))。

【0034】また安定した電極厚や導電ペーストとニッケルめっき層との密着を向上させるためニッケルめっき直前に無電解銅めっき層を導電ペースト層の上に実施することもある。

【0035】<本実施形態の利点>このように本実施の形態におけるプリント配線板の構成および製造方法によれば、次のような効果が得られる。

【0036】(1) 部品実装に必要なパターン上幅を確保でき、実装時の位置ずれに関して許容度が大きくなる。部品を実装するパターンの上幅は導電ペースト層1 2の幅により決まり、この幅はスクリーン方式の場合、使用するマスクの幅によりコントロールされるものであって、パターン5のエッチング状態に左右されることはないため、一定の安定した部品実装電極幅が得られる。

【0037】(2) 基板の実装電極の表面には図3に示されるように多数の凹凸があるため実装する部品が基板の電極からずれ落ちて傾いたりしない。本実施形態では実装電極は導電ペーストからなっているため金属粉により電極表面には多数の凹凸がある。たとえば平均粒径3 μ mの球状銀粉に粒径0.1~2 μ mの鱗片状銀粉を混合してなる導電ペーストによって形成した電極表面は平均粗さで2.0~3.0 μ mであり、この凹凸によるアンカー効果により、部品実装時に圧力がかかっても部品が基板の電極上を滑ったり、ずれ落ちて傾いたりしないため実装歩留まりが向上する。

【0038】(3) 基板の実装電極の表面には図3に示されるように多数の凹凸があるため実装する部品と基板の電極との接続信頼性が向上する。ワイヤボンディング方式やフリップチップ方式においても実装電極に適度な凹凸があればアンカー効果で密着性が上がるため接続信頼性が向上する。たとえばボンディング強度を表す指標としてボールせん断強度を従来の基板と比較すると1.4倍向上することがわかった。

【0039】またペアチップをフリップチップ実装する際に注入するアンダーフィル材の密着性も向上する。

【0040】(4) 基板が平坦なためソルダレジストを形成する場合、図4に示すように従来の基板であればパターン間隙で印刷かすれによるソルダレジスト1 3の未

着1 4やボイド1 5が発生する。特に今後、ファインパターン化が進み、パターンの間隙が狭くなると顕著になる。本実施形態では絶縁樹脂層1 1で基板が平坦化されているため、未着1 4やボイド1 5の発生もないばかりか薄く、均一に塗布できる。

【0041】(5) ペアチップを基板にフリップチップ実装する際のアンダーフィル材の注入が容易でボイドの発生がない。図5に示すようにフリップチップ実装においてはペアチップ8と基板1 0の隙間に接続信頼性向上のため、封止樹脂1 6を注入することが多い。この注入工程では、パターンの狭ピッチ化が進む中、いかにボイドの巻きこみをなくして早く注入させられるかが大きな課題となっている。

【0042】従来の基板ではボイド1 7の発生を抑えるのは困難であったが、本実施形態では絶縁樹脂層1 1により基板表面が平坦化されているため、ボイドの発生が格段に減少し、注入の時間が大幅に短縮される。なお、この封止樹脂の代わりに樹脂の硬化収縮を利用してペアチップと基板の電気接続を保つ圧接工法の場合で、樹脂がペースト状以外にフィルム状のもの、あるいは樹脂に導電粒子を含むもの、含まないものを使用する場合も同様の効果がある。

【0043】(6) 高密度基板やペアチップ基板として汎用されているビルトアップ配線基板は絶縁樹脂上に析出させた銅めっき層によって、配線パターンおよび部品実装パターンを形成していることから、銅はくのピール強度やブル強度が低いため、基板からの部品脱落が問題となっている。本実施形態による基板は銅はくの側面が絶縁樹脂層により覆われているため、ピール強度やブル強度が大幅に向上する。

【0044】(実施の形態2) 図6は本発明の実施の形態2におけるプリント配線板の製造工程図である。

【0045】基材2と銅はく3からなる配線基板1 0(図6 (A))に実施の形態1と同様の導電ペースト1 2を所定のパターンとなる銅はく上に塗布する(図6 (B))。

【0046】この導電ペースト1 2をエッチングレジストとして、塩化第2銅などのエッチング液により不要な銅はくを除去して所定のパターン5を形成する(図6 (C))。

【0047】その後、必要に応じて配線基板の表面に部品実装部分を残してソルダレジストを塗布したうえで、実施の形態1と同様、仕上げ処理として、部品実装部分などの導電ペースト層が露出した部分に無電解ニッケルめっき6および無電解金めっき7を施す。

【0048】本実施形態においても部品実装に必要なパターン上幅を確保できるとともに基板の実装電極の凹凸によるアンカー効果により部品が基板の電極からずれ落ちることがない。また密着力が強固となるため接続信頼性も向上する。

【0049】

【発明の効果】以上のように、本発明によれば、絶縁基板上に形成された台形状断面を有する導体パターンの上辺に表面凹凸を有する導電ペースト層を形成し、この導電ペースト層の幅が前記台形状断面を有する導体パターンの上辺の幅よりも大であるプリント配線板により、部品を実装する際の位置ずれに関する許容度が大きくなるとともに部品が基板の電極上を滑ることがないため、接触不良の抑制に有効な優れたプリント配線板を実現できるものである。

【図面の簡単な説明】

【図1】本発明の実施の形態1におけるプリント配線板の製造方法を示す工程断面図

【図2】同工程断面図

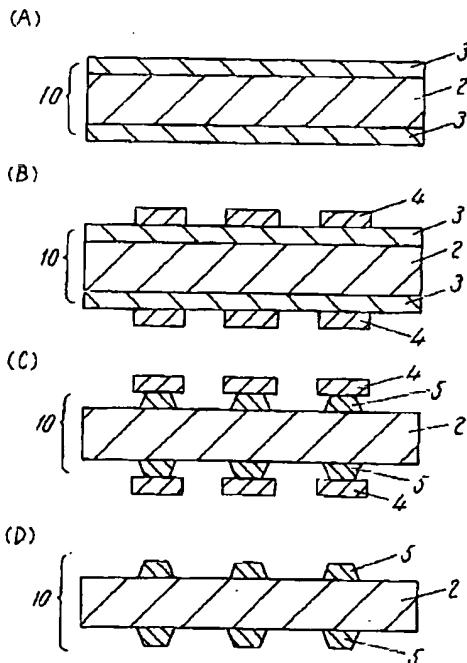
【図3】本発明の実施の形態1におけるプリント配線板との部品の実装状態を示す断面図

【図4】同じくソルダレジストの形成状態の比較を示す断面図

【図5】同じく封止樹脂の形成状態の比較を示す断面図

【図6】本発明の実施の形態2におけるプリント配線板の製造方法を示す工程断面図

【図1】



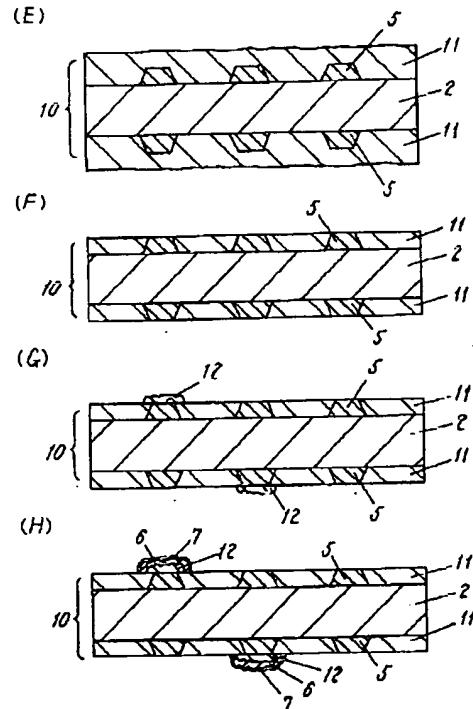
【図7】従来のプリント配線板の製造方法を示す断面図

【図8】従来のプリント配線板との部品の実装状態を示す断面図

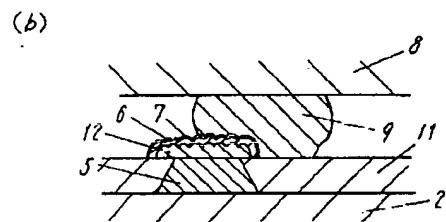
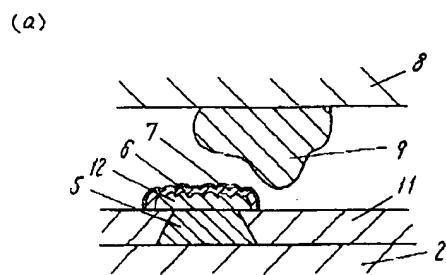
【符号の説明】

- 1 銅張り積層板
- 2 基材
- 3 銅はく（導体層）
- 4 エッチングレジスト
- 5 パターン
- 6 無電解ニッケルめっき層
- 7 無電解金めっき層
- 8 ベアチップ
- 9 バンプ
- 10 配線基板
- 11 絶縁樹脂層
- 12 導電ペースト
- 13 ソルダレジスト
- 14 ソルダレジストの未着
- 15 ソルダレジスト中のボイド
- 16 封止樹脂
- 17 封止樹脂中のボイド

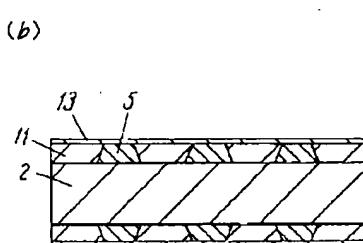
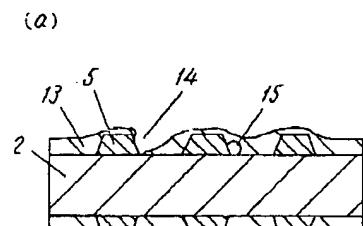
【図2】



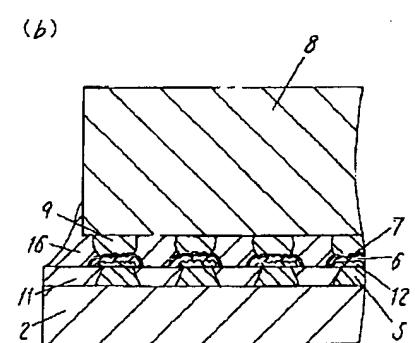
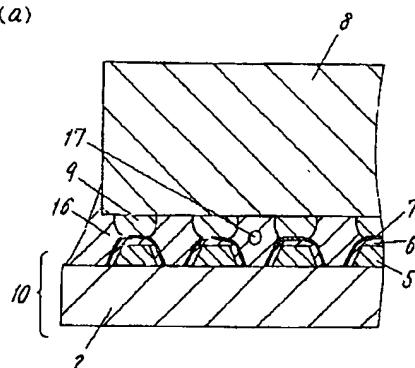
【図3】



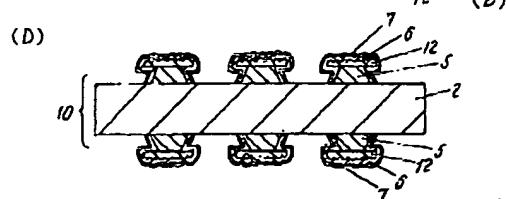
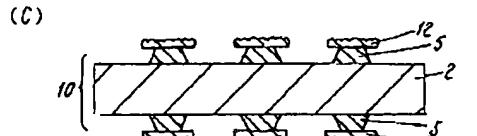
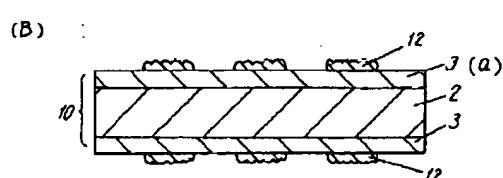
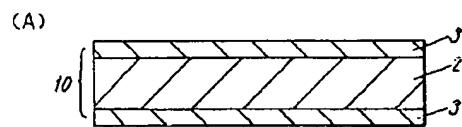
【図4】



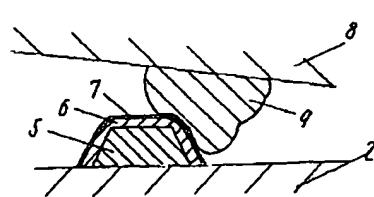
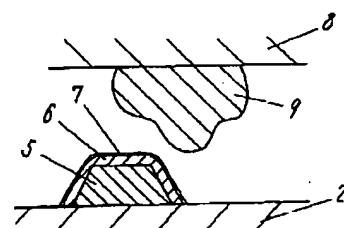
【図5】



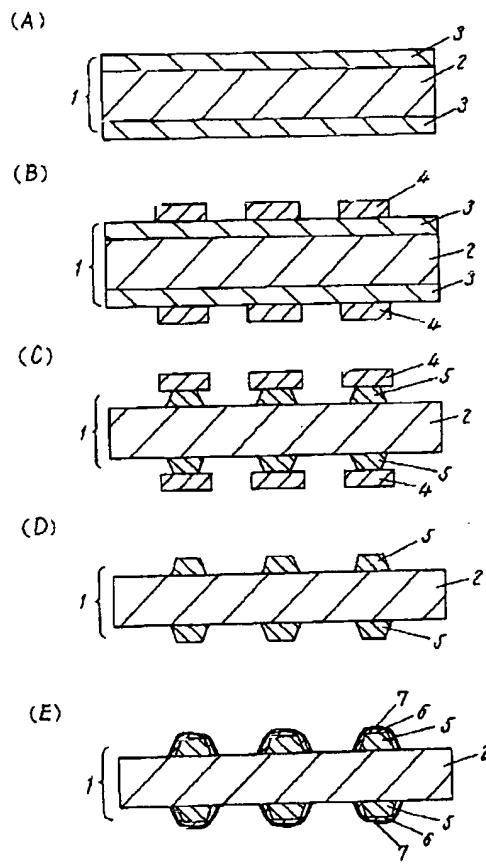
【図6】



【図8】



【図7】



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